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ABSTRACT

Designed to provide instructional materials for use by vocational agriculture teachers, this unit on feeding livestock contains nine lessons based upon competencies needed to be a livestock producer. The lessons in this unit cover the importance of good feeding practices, the identification of nutritional needs and the composition of feeds for farm livestock, how livestock use their food, providing vitamins and minerals for livestock, balancing rations for livestock, using protein supplements and forages, and the importance of providing clean water for livestock. Each lesson contains the following: (1) a performance objective, (2) teaching-learning activities, (3) supplementary materials, and (4) a criterion-referenced measure. Suggestions for using problem-solving procedures, resource persons, field trips, and audio-visual aids are outlined in the section on teaching-learning activities provided for each lesson. Transparency masters of charts, tables, and illustrations are included in most lessons. (Related documents contain similar instructional materials on breeding livestock, livestock judging, dairy housing and equipment, tobacco production, and corn production--see note.) (MN)

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F E E D I N G L I V E S T O C K

A Unit for Teachers of Vocational Agriculture

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FEEDING LIVESTOCK

Number of class periods _____ Month(s) _____

INTRODUCTION

The proper feeding of livestock requires competence in many areas. Livestock producers across the state are constantly trying to improve feed efficiency, lower feed costs and improve feed-handling facilities. This unit is designed to teach students of agriculture/agribusiness the basics of animal nutrition, composition of common feedstuffs, calculation of rations and feeding management principles. The learnings in this unit can best be applied by the student with his/her home farm experience program. Job titles that deal with feeding livestock include: dairyman, rancher, farmer, feedlot manager, animal herdsman, animal nutritionist, veterinarian, feed store manager, feed salesman, field representative, agriculture instructor and farm manager.

Lessons found in this unit are based upon competencies needed to be a livestock producer and are adapted from the National Agricultural Occupations Competency Study. They are as follows:

1. Importance of good feeding practices
2. Identifying nutritional needs and composition of feeds for farm livestock
3. How livestock make use of their feed
4. Providing minerals for livestock
5. Providing vitamins for livestock
6. Balancing rations for livestock
7. Using protein supplements in the ration
8. Using forages in feeding livestock
9. Importance of providing clean water for livestock

DIRECTIONS

Each lesson listed is followed by: 1) a performance objective, 2) teaching-learning activities (including technical content), 3) supplemencary materials (including transparency masters and lists of references), and 4) check out activities. Since the knowledge that can be obtained in each of these lessons is necessary to be a successful livestock producer,

all the lessons should be taught unless local circumstances or previous learnings would cause this to be unnecessary. They do not necessarily need to be taught in the order listed. The transparency masters can also be copied and used for handouts the students can keep in their notebooks.

1. IMPORTANCE OF GOOD FEEDING PRACTICES

1.1 Performance Objective

Given a written check-out activity concerning good feeding practices, the student will complete the check-out with 80 percent accuracy.

1.2 Teaching-Learning Activities

a. This section on the importance of good feeding practices can best be taught using the problem-solving procedure. Prepare appropriate problems for class use.

b. Take a field trip to a feed mixing operation or a farm to see feed and compare costs of various types of feeds.

c. Use a field representative from a feed company, extension personnel, or farmer as a resource person.

d. Obtain feed and/or feed tags to show students.

1.2.1 The importance of proper livestock feeding:

a. Feeding accounts for the largest percentage of total cost in producing livestock and livestock products.

(1) Nearly 50 to 60 percent of the cost of producing whole milk is for feed.
(2) Feed cost for producing market hogs accounts for 65 to 75 percent of the total cost of production, for feedlot lambs - 50 percent, finishing cattle - 70 percent.
(3) Approximately 60 percent of the cost of producing poultry and eggs is for feed.

b. Feeding is the most critical factor in securing efficient livestock production.

c. Feeding is a major factor in determining health of farm animals. Good feeding practices are essential in preventing such nutritional disorders as common scours, anemia, ketosis, and rickets. Proper feeding management will do much to prevent bloat in cattle.

d. The proper feeding of livestock can increase net returns faster then any other area of improvement.

e. Feeding practices are a major consideration in managing livestock.

f. Feeding management greatly affects returns per hour of labor, thus effecting efficiency in farming.

g. Approximately one-half of the feed eaten by livestock is for body maintenance.

1.3 Supplementary Materials

References: See books listed at end of unit under List of References.

1.4 Check-Out Activities

Provide students with the following exercise:

1. What is the total cost of feed in:

   a. Producing milk?
   b. Raising market hogs?
   c. Producing beef?
   d. Producing lamb?
   e. Producing poultry and eggs?

2. List five reasons why feeding livestock properly is important.

ANSWERS:

1. a. 50-60 percent
   b. 60-75 percent
   c. 70 percent
   d. 50 percent
   e. 60 percent

2. a. Feeding accounts for largest percent of total cost in producing livestock and livestock products.
   b. Feeding is the most critical factor in securing efficient livestock production.
   c. Feeding is a major factor in determining health of farm animals.
   d. The proper feeding of livestock can increase net returns faster than any other area of improvement.
   e. Feeding practices are a major consideration in managing livestock.
   f. Feeding management greatly affects returns per hour of labor, thus effecting efficiency in farming.
   g. Approximately one-half of the feed eaten by livestock is for body maintenance.

2. IDENTIFYING NUTRITIONAL NEEDS AND COMPOSITION OF FEEDS FOR FARM LIVESTOCK

2.1 Performance Objective

Given a written check-out activity requiring identification of nutritional needs and composition of feeds for farm livestock, the student will complete the activity with 80 percent accuracy.

2.2 Teaching-Learning Activities

a. This section on the identification of nutritional needs of livestock can best be taught using the problem-solving procedure. Prepare appropriate problems for class use.

b. Take a field trip to a university or feed company experimental farm to observe the results obtained with different feeds.

c. Use a fieldman from a feed company, extension personnel, or a farmer as a resource person.

d. Obtain feed ingredients, feed samples, and/or feed tags for students to compare.

2.2.1 Nutrients needed by farm animals:

a. Carbohydrates

b. Fats

c. Proteins

d. Vitamins

e. Minerals

f. Water

2.2.2 Animals use nutrients to:

a. Maintain their bodies and carry out the processes necessary for life.

b. Replace and repair used and damaged body tissue.

c. Produce animal products (meat, milk, eggs, wool, etc.).

d. Develop the unborn young.

e. Do work.

2.2.3 Composition of animals and animal products:

(See transparency master 2.2.3a.)

2.2.4 Composition of feeds:

The composition of feed varies greatly. Most feeds derived from crops contain the following nutrients in some combinations:

a. Water (varies from 10 percent in dried grains to 70-75 percent in some pastures).

b. Starch and sugars (commonly known as carbohydrates or simple sugar).

c. Fat

d. Fiber (primarily lignin and cellulose)

e. Mineral or ash

f. Proteins

g. Vitamins

Example: Average composition of dried corn: carbohydrates, 73.4 percent; water, 10.8 percent; protein, 9.2 percent; fat, 4.3 percent; and, minerals, 1.5 percent.

2.3 Supplementary Materials

References: 1. See books listed under List of Resources at back of unit.

2. Nutrient Requirements of Dairy Animals and Composition of Feedstuffs, ASC-34.

Transparency Master: 2.2.3a, "Approximate Composition of Animals and Animal Products in Percent."

2.4 Check-Out Activities

Provide students with the following exercise:

1. Give six nutrients needed by livestock.

2. List four ways in which livestock use nutrients.

3. List five common nutrients found in livestock feedstuffs.

ANSWERS:

1. a. Carbohydrates
   b. Fats
   c. Proteins
   d. Vitamins
   e. Minerals
   f. Water

2. a. Maintain their bodies and carry out the processes necessary for life.
   b. Replace and repair used and damaged body tissues.
   c. Produce animal products (meat, milk, eggs, wool, etc.)
   d. Develop the unborn young.
   e. Do work.

3. a. Water
   b. Starch and sugars (commonly known as carbohydrates or simple sugar).
   c. Fat
   d. Fiber (primarily lignin and cellulose)
   e. Mineral or ash
   f. Protein
   g. Vitamins

APPROXIMATE COMPOSITION OF ANIMALS AND ANIMAL PRODUCTS IN PERCENT

Animal or Product	Percent Water	Percent Protein	Percent Fat	Percent Mineral	Percent Other
Dairy Animal (at birth)	74	19	3	4	
Dairy Cow	57	17	21	5	
Market Barrow	50	14	28	2.5	5.5 (fill)
Fat Steer	48	16	32	4	
Milk	87	4	4	0.7	4.3 (milk sugar)
Eggs	65	14	10	11	

TM 2.2.3a

3. HOW LIVESTOCK MAKE USE OF THEIR FEED

3.1 Performance Objective

Given a written check-out activity concerning the ways livestock make use of their feed, the student will complete the activity with 80 percent accuracy.

3.2 Teaching-Learning Activities

a. This section on how livestock make use of their feed can best be taught by using the problem-solving procedure. Prepare appropriate problems for class use.

b. Use a fieldman from a feed company, extension personnel, or a farmer as a resource person.

c. Take a field trip to a packing company to observe the digestive systems of as many types of animals as possible or dress out one or two small animals at the school and allow students to observe the digestive systems.

d. Show slides of digestive systems (not included in this unit).

e. Use transparencies or handouts produced from transparency master 3.2.1a.

3.2.1 Digestive systems of farm animals:

a. Compound stomach - ruminant animals have four (4) stomach compartments. The ruminant animals' primary feed is roughage. Sheep and cattle are ruminant animals.

b. Simple stomach animals - monogastic animals have a single stomach compartment and a digestive system very similar to man's. Examples include hogs and horses. (It should be noted that horses have an accessory organ called the cecum which enables them to utilize roughages much like a ruminant animal.)

3.2.2 Approximate digestability of feedstuffs:

a. Concentrates, 80-90 percent; examples: corn, other grains and pelleted feeds.

b. High quality roughages, 50-60 percent; examples: alfalfa hay or any good legume hay or pasture.

c. Poor quality roughages, 40 percent or less; examples: poor quality grass hay, fescue pasture in the hot summer months.

3.2.3 Functions and/or uses of feedstuffs utilized by livestock:

a. Growth

b. Body maintenance

c. Repair of body tissues

d. Reproduction and formation of unborn young

e. Production of saleable products--examples: wool, milk, meat, etc.

f. Fat (for storage of energy)

g. Production of work

3.2.4 Functions of nutrients in feedstuffs fed to livestock:

a. Protein builds muscles and new tissues, repairs worn-out or damaged tissues, is essential in the production of saleable livestock products (wool, milk, meat, etc.). Excess protein fed to livestock is stored as fat. Protein is mismanaged in the diets of livestock more than any other nutrient.

b. Carbohydrates are primarily used for energy and heat in the production of simple sugars. Excess carbohydrates are stored as fats.

c. Fats serve the same purpose as carbohydrates but give 2¼ times more energy per unit than carbohydrates.

d. Minerals are essential in the formation of bones, teeth and hide and are essential to most body processes.

e. Water softens feed, aids in digestion and assimilation of nutrients, and is essential in the elimination of waste products.

f. Vitamins regulate body functions, help body tone, and aid in building resistance to infection and disease.

3.3 Supplementary Materials

References: See books listed under List of Resources at back of unit.

Transparency Masters: 3.2.1a, "Digestive Tracts."

Movies: 1. The Biotin Story.

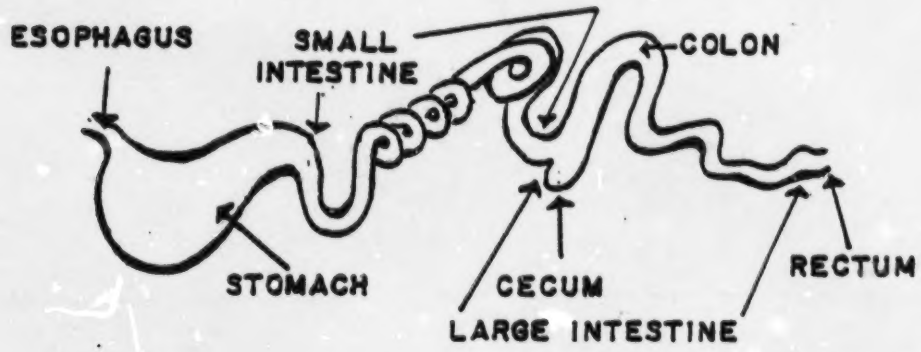
2. Plus or Minus Vitamin E.

3. The Protein Bonus

Slides: Ruminant Stomachs in Beef Animals.

DIGESTIVE TRACTS

PIG



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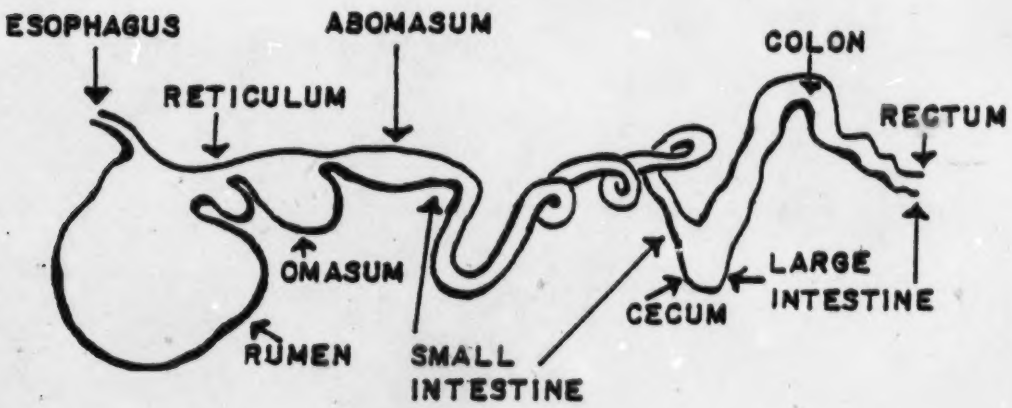


3.4 Check-Out Activities

Provide students with the following exercise:

1. Name the two types of digestive systems found in livestock.

2. What is the approximate digestability of concentrates?

3. What is the approximate digestability of a high quality roughage?

4. What is the approximate digestability of a poor quality roughage?

5. List four functions of the nutrients needed by livestock.

6. What is the function of each of the following nutrients in relation to the nutrition of livestock?

   a. Proteins
   b. Carbohydrates
   c. Fats
   d. Minerals
   e. Water
   f. Vitamins

ANSWERS:

1. a. Compound stomachs--ruminant animals
   b. Simple stomach animals

2. 30-90 percent

3. 50-60 percent

4. 40 percent or less

5. a. Growth
   b. Body maintenance
   c. Repair of body tissues
   d. Reproduction and formation of unborn young
   e. Production of saleable products - examples: wool, milk, meat, etc.
   f. Fat (for storage of energy)
   g. Production of work

6. a. Protein builds muscles and new tissues, repairs worn-out or damaged tissues, is essential in the production of saleable livestock products (wool, milk, meat, etc.). Excess protein fed to livestock is stored as fat. Protein is mismanaged in the diets of livestock more than any other nutrient.

b. Carbohydrates are primarily used for energy and heat in the production of simple sugars. Excess carbohydrates are stored as fats.
c. Fats serve the same purpose as carbohydrates but give 2½ times more energy per unit than do carbohydrates.
d. Minerals are essential in the formation of bones, teeth and hide and are essential to most body processes.
e. Water softens feed, aids in digestion and assimilation of nutrients, and is essential in the elimination of waste products.
f. Vitamins regulate body functions, help body tone, and aid in building resistance to infection and disease.

4. PROVIDING MINERALS TO LIVESTOCK

4.1 Performance Objective

Given a written check-out activity concerning providing minerals to farm livestock, the student will complete the activity with 80 percent accuracy.

4.2 Teaching-Learning Activities

a. This lesson on providing minerals to livestock can best be taught using the problem-solving procedure. Prepare appropriate problems for class use.

b. Use a resource person with nutrition training such as a nutritionist at a hospital or a home economics teacher.

4.2.1 Definition of a mineral:

Minerals are the inorganic elements of animals and plants. They can be determined by burning off the organic matter; the remaining residue or ash is the mineral content.

4.2.2 Functions of minerals:

a. Give rigidity and strength to the skeleton system.

b. Serve as constituents of the organic compounds, such as protein and lipids, which make up other parts of the animal body.

c. Serve to activate enzyme systems.

d. Help control fluids in the body.

e. Regulate acids and bases in the body.

f. Help regulate and control nerves in the body.

4.2.3 Minerals needed by livestock:

Macro or Major Minerals	Trace or Micro Minerals
Sodium (Na)	Chromium (Cr)
Chlorine (Cl)	Cobalt (Co)
Calcium (Ca)	Copper (Cu)
Phosphorous (P)	Flourine (F)
Magnesium (Mg)	Iodine (I)
Potassium (K)	Iron (Fe)
Sulfur (S)	Manganese (Mn)
	Molyebdum (Mo)
	Selenium (Se)
	Silicon (Si)
	Zinc (Zn)

Most of the major minerals are present in feedstuffs for livestock with the exception of sodium and chlorine (salt). Phosphorous and calcium may also be lacking. Most trace minerals are not usually needed unless your area is lacking in a particular mineral. (Exceptions include baby pigs in confinement. These need iron shots or supplements. Also, some areas of Kentucky have pastures deficient in selenium.)

4.2.4 Providing salt for livestock:

a. Salt is needed more by grass-eating animals than other species.

b. Salt may be provided free choice in loose or block forms.

c. Loose salt is preferred since animals will not spend as much time trying to lick the block, do not damage teeth, and more timid animals will get their requirements.

d. Trace mineral salt can be provided in areas where some of the micro minerals are deficient.

4.2.5 Providing calcium and phosphorous for livestock:

a. Livestock are more likely to suffer from lack of Ca and P than any other mineral except salt.

b. Seventy percent of the mineral content of animals is Ca and P.

c. For livestock to utilize Ca and P:

(1) Ca and P supplies should be adequate and in an available form.
(2) The Ca to P ratio should be approximately 2:1.
(3) If plenty of vitamin D is present, the ratio is not critical.
(4) Ca and P supplements should be low in flourine.
(5) In a mixed feed ration, 0.25-0.50 percent trace mineral salt plus Ca and P added as needed to balance the ration will meet most livestock needs (when low levels of salt are in the ration-feed trace mineral salt free choice).
(6) When livestock are fed an unmixed ration or are on pasture:

(a) With liberal grain feeding, provide free access to a two compartment mineral box with one side having trace mineral salt and the other side having a mixture of 1/3 trace salt (for palatability), 1/3 steamed bone meal or deflourinated rock phosphate and 1/3 ground limestone or oystershell flour.
(b) When livestock are primarily on a roughage ration, provide a two compartment mineral box with one side having trace mineral salt the other having a 1/3 trace mineralized 2/3 steamed bone meal mixture.

4.2.6 Characteristics of feeds in regard to Ca and P:

a. Cereal grains and their by-products, dry mature grasses and vegetable protein supplements are <u>low</u> in calcium.

b. Protein supplements of animal origin and from legumes are <u>high</u> in calcium.

c. Cereal grains and their by-products are high in P but much of the P may not be available for livestock use.

d. Most nonlegumes are low in P.

e. The Ca and P content of plants can be increased through proper fertilization of the soil in which they are grown.

4.3 <u>Supplementary Materials</u>

References: See books listed under List of Resources at back of unit.

4.4 <u>Check-Out Activities</u>

Provide students with the following exercise:

1. Define mineral.

2. List five major minerals.

3. List five functions of minerals.

4. Are cereal grains high or low in Ca?

5. Are cereal grains high or low in P?

6. Ruminant animals need more salt in their diet than nonruminants. T F

7. Salt should be fed in the block form to prevent wastage. T F

ANSWERS:

1. Minerals are the inorganic elements of animals and plants.

2. a. Sodium (Na)
   b. Chlorine (Cl)
   c. Calcium (Ca)
   d. Phosphorous (P)
   e. Magnesium (Mg)
   f. Potassium (K)
   g. Sulfur (S)

3. a. Give rigidity and strength to skeleton system.
   b. Serve as constituents of the organic compounds.
   c. Serve to activate enzyme systems.
   d. Help control fluids in the body.
   e. Regulate acids and bases in the body.
   f. Help regulate and control nerves in the body.

4. Low

5. High

6. True

7. False

5. PROVIDING VITAMINS TO LIVESTOCK

5.1 Performance Objective

Given a written check-out activity concerning providing vitamins to livestock, the student will complete the activity with 80 percent accuracy.

5.2 Teaching-Learning Activities

a. This lesson on providing vitamins to livestock can best be taught using the problem-solving procedure. Prepare appropriate problems for class use.

b. Have someone with nutrition training serve as a resource person.

c. Have samples of feed that are high in various vitamins for students to observe.

5.2.1 Definition of a vitamin:

A vitamin is an organic compound essential to the health, growth, production and/or reproduction of farm animals and is required in minute amounts.

5.2.2 Characteristics of vitamins:

a. Fifteen definite vitamins, having known chemical formulas, have been identified. There are probably several vitamins not yet discovered.

b. Vitamins were first designated by letters; those more recently identified were given names.

c. Only vitamins likely to be deficient are important to consider when feeding livestock.

5.2.3 Effects of vitamin deficiencies on farm animals:

a. Vitamin A - Night blindness and increased susceptibility to eye infection.

b. Vitamin D - Rickets and poor bone structure. (Vitamin D is also needed for the proper assimilation and use of Ca and P.)

c. Vitamin E - Poor muscle formation.

d. Vitamin B_2 (Riboflavin) - Digestive disturbances, general weakness, nervous system impairment, low resistance to disease, paralysis of legs in poultry, stiff legs and skin lesions in swine.

e. Vitamin B_{12} - Slow growth in swine, high death rate in swine litters.

f. Niacin - Rough skin, diarrhea, loss of appetite, slow growth (only poultry and swine suffer from niacin deficiency).

g. Other lesser important vitamins for consideration are: choline; thiamine (not deficient in most livestock feeds); Vitamin C or ascorbic acid (synthesized in the bodies of all farm animals); and Vitamin K (necessary for blood clotting) which is deficient only in baby chickens and animals that are on sweet clover pasture.

5.2.4 Sources of vitamins for farm animals:

a. Vitamin A - Good sources are fresh green forages, good legume hay, yellow corn, fish oils and whole milk.

b. Vitamin D - All feed cured in the ultraviolet ray from the sun contain the D vitamins.

c. Vitamin E - This vitamin is abundant in all of the cereal grains.

d. Vitamin B_2 - Milk and dairy products are good sources as well as any of the feedstuffs that are the by-products of distillation.

e. Vitamin B_{12} - Tankage and fish meal are excellent sources.

f. Niacin - Forages are excellent sources of niacin; barley and wheat also contain large amounts.

5.3 Supplementary Materials

References: See books listed under List of Resources at back of unit.

5.4 Check-Out Activities

Provide students with the following exercise:

1. Define vitamins.

2. List five major vitamins.

3. List the function of each of the five vitamins you listed in number two above.

4. What feed would you use to prevent deficiencies for each of the following vitamins? Vitamin A, B_{12}, D, E, and Niacin?

ANSWERS:

1. A vitamin is an organic compound essential to the health, growth, production, and/or reproduction of livestock and is required in minute amounts.

2. and 3.

   a. Vitamin A - Night blindness and increases susceptibility to eye infection.
   b. Vitamin D - Rickets and poor bone structure (Vitamin D is also needed for the proper assimilation and use of Ca and P).
   c. Vitamin E - Poor muscle formation.
   d. Vitamin B_2 (Riboflavin) - Digestive disturbances, general weakness, nervous system impairment, low resistance to disease, paralysis of legs in poultry, stiff legs and skin lesions in pigs.
   e. Vitamin B_{12}-Slow growth in swine, high death rate in swine litters.
   f. Niacin - Rough skin, diarrhea, loss of appetite, slow growth.

4. a. Vitamin A - Good sources are fresh green forages, good legume hay, yellow corn, fish oils and whole milk.
   b. Vitamin D_2 and D_3 - All feed cured in ultraviolet rays from the sun contain the D vitamins; animals also get the vitamin from being exposed to sunlight.
   c. Vitamin E - Abundant in all of the cereal grains.
   d. Vitamin B_2- Milk and dairy products and by-products of distillation processes are good sources.
   e. Vitamin B_{12}-Tankage, fish meal.
   f. Niacin -Forages are excellent sources of niacin; barley and wheat also contain large amounts.

6. BALANCING RATIONS FOR LIVESTOCK

6.1 Performance Objective

Given a written check-out activity concerning balancing rations for livestock, the student will complete the activity with 80 percent accuracy.

6.2 Teaching-Learning Activities

This lesson on calculating rations can best be taught using the problem-solving procedure. Prepare appropriate problems for class use.

6.2.1 Definition of a ration:

a. A ration is the daily intake of feed by livestock.

b. A balanced ration is the daily intake of feed required to meet an animal's daily nutritional requirements.

6.2.2 Using the Pearson Square Method to balance rations:

a. This method is simple, direct and easy.

b. It permits quick substitutions of feed ingredients in keeping with changing market prices for feedstuffs.

c. The Pearson Square Method primarily balances the protein needed.

d. An example is as follows:

Given: A swine producer has 40-pound pigs which he desires to feed a 16 percent protein ration until they reach 80-90 pounds in weight. He has on hand corn containing 9.5 percent protein. He may purchase a 36 percent protein supplement with vitamins and minerals added. What percentage of the ration should consist of corn and what percentage should consist of the supplement?

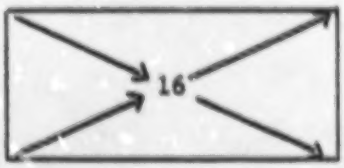
The step-by-step procedure is as follows:

(1) Draw a square and place the percentage of desired protein in the center (16).
(2) In the upper left-hand corner of the square, write protein supplement and its percentage protein (36).
(3) In the lower left-hand corner, write corn and its protein percentage (9.5).

(4) Subtract diagonally across the square (always the smaller number from the larger) and write the difference at the corners on the right-hand side. (36-16 = 20 and 16-9.5 = 6.5) The number in the upper right-hand corner gives the parts of protein supplement by weight, and the number at the lower right-hand corner gives the parts of corn by weight to make a ration with 16 percent protein. (See transparency master 6.2.2a.)

(5)

Protein Supplement -- 36 → 6.5 Parts Supplement



Corn -- 9.5 → 20.0 Parts Corn

26.5 Total Parts

(6) To determine what percentage of the total ration should be corn, divide the parts corn by the total parts (20 ÷ 26.5 = 75 percent corn). The remaining 25 percent would be protein supplement. Thus, 75 pounds out of every 100 pounds should be corn, and 25 pounds should be protein supplement.

(7) To determine total pounds of corn needed for a ton of feed: .75 x 2000 = 1500 pounds of corn. (Note: There are 2000 pounds per ton.).

(8) Precautions about using the Pearson Square:

(a) It can only be used for two feed materials. However, either or both of these can be mixtures and you simply use the average percentage.

(b) The number must be intermediate to the two numbers at the left corners of the square.

6.2.3 Before attempting to balance any ration, the following should be considered:

a. Availability and cost of the different feed ingredients.

b. Moisture content--consider feeds on an air dry basis (10 percent moisture).

c. Composition of feedstuffs--many feedstuffs vary greatly; examples: silages, pasture, and mixed hays.

d. The nutritional needs of the livestock in question.

e. The palatability and digestability of the feed ingredients.

6.3 Supplementary Materials

References: See books listed under List of Resources at back of unit.

Transparency Master: 6.2.2a, "Example of Pearson Square Method of Balancing a Ration."

6.4 Check-Out Activities

Provide the students with the following exercise:

1. Define a ration.

2. Define a balanced ration.

3. Solve the following feeding problem:

   Given: A dairy producer has a herd of replacement heifers that he/she wishes to feed a ration containing 14 percent protein. The producer has on hand yellow shelled corn with a protein content of 9.2 percent and can purchase Soybean Oil Meal protein supplement with a protein content of 44 percent. How many pounds of supplement will the dairy producer use to mix a ton of complete feed for the dairy heifers? How many pounds of corn will he/she need to prepare the ton of feed?

   Show all work!

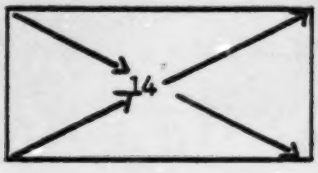
ANSWERS:

1. A ration is the daily intake of feed by livestock.

2. A balanced ration is the daily intake of feed required to meet an animal's daily nutritional requirements.

3. Protein

Supplement -- 44 — 4.8 Parts Supplement



Corn -- 9.2 — 30.0 Parts Corn

34.8 Total Parts

44 - 14 = 30

14 - 9.2 = 4.8

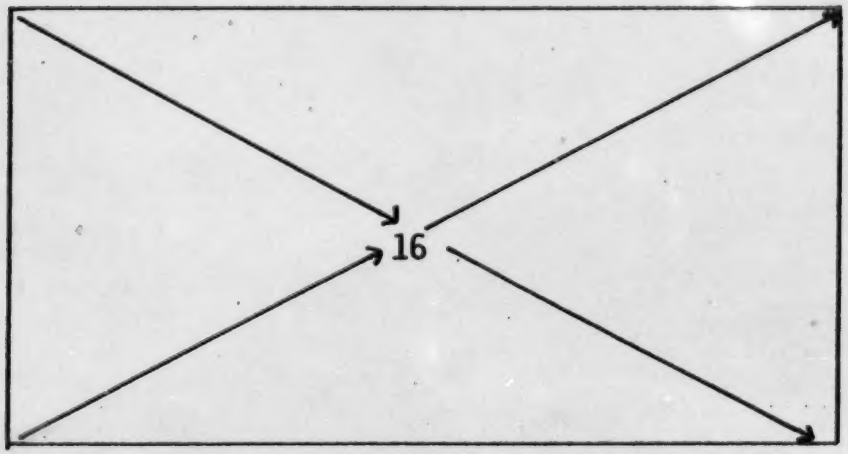
27

Divide parts corn by total parts -- 30 ÷ 34.8 = .86 or 86 percent. The remaining 14 percent would be protein supplement.

To determine total pounds of corn needed for a ton of feed, multiply .86 x 2000 = 1720 pounds of corn.

EXAMPLE OF PEARSON SQUARE METHOD OF BALANCING A RATION

PROTEIN SUPPLEMENT 36



CORN 9.5

6.5 PARTS SUPPLEMENT

20.0 PARTS CORN

26.5 TOTAL PARTS

TM 6.2.2a

7. USING PROTEIN SUPPLEMENTS IN THE RATION

7.1 Performance Objective

Given a written check-out activity concerning the use of protein supplements in the ration, the student will complete the activity with 80 percent accuracy.

7.2 Teaching-Learning Activities

a. This section on the importance of using protein supplements can best be taught using the problem-solving procedure. Prepare appropriate problems for class use.

b. Secure samples of protein supplements to show the students.

7.2.1 Using urea as a protein source:

a. Urea is not a protein but a nitrogen compound from which the micro-organisms of the ruminant animal may synthesize proteins.

b. Considerations affecting use of urea:

(1) Animals need a high level of rumen bacteria to utilize ureas (only ruminant animals may utilize urea).
(2) It takes 2-4 weeks for livestock to adjust to urea in the ration.
(3) Low amounts of natural protein should be in the ration. (Large amounts of natural protein may depress the utilization of urea because the ruminant organisms prefer the natural proteins.)
(4) When using urea, some feedstuffs in the ration should be higher in energy in order to use high fiber filler feeds such as corn cobs, cottonseed hulls, etc.
(5) Response to urea is greater on high energy, high roughage rations.
(6) Urea supplements should be stored away from moisture as they will readily absorb water from the air.
(7) Do not feed urea to cattle the first 21-28 days after purchase. (Such animals have lost their fill and should be allowed to adjust to the new ration gradually.)
(8) Urea supplements should be well mixed. (Urea in concentrated forms is toxic to livestock.) Do not over feed urea.
(9) Do not feed urea to starved livestock or those animals that have been off feed for as long as 36 hours.
(10) Formulate rations in which no more than 33 percent of the crude protein is derived from urea.
(11) Feed iodized salt to animals on rations containing urea. (It makes the ration more palatable and helps hide the taste of the urea.)

7.2.2 Using other sources of protein:

a. Use protein from animal sources (tankage, meat scraps, skim milk, fish meal).

b. Use protein from plants (soybean meal, linseed meal, cottonseed meal, ground or dehydrated alfalfa leaf meal, distilled grain by-products).

7.2.3 Factors affecting selection of protein supplements:

a. Protein is generally the most expensive nutrient in animal's feeds.

b. Home grown sources of protein can best be provided with good legume hays.

c. Protein is the most commonly lacking nutrient in an animal ration.

d. Feeding too much protein is wasteful and expensive. Feeding too little protein will result in lower animal production.

e. Select the best protein supplement for the kind and type of animal to be fed and giving the most protein per dollar spent.

7.2 Supplementary Materials

References: 1. See books listed under List of Resources in back of unit.

2. Effects of Feeding Nitrates to Dairy Cattle, ASC-35.

3. Salvage Feeds for Beef Cattle, ID-9.

7.4 Check-Out Activities

Provide students with the following exercise:

1. Urea can only be used in the rations of _____.

2. Animals should have a high bacteria level in the rumen when feeding urea. T F

3. It is essential that high quality natural protein be fed along with urea supplements. T F

4. One of the main advantages of using urea is that other feedstuffs in the ration can be of lower quality. T F

5. A high energy, high roughage ration will give a better response to urea supplementation. T F

6. Urea should be fed free choice to all cattle. T F

7. No more than 33 percent of the crude protein of a ration should be urea. T F

8. Iodized salt should be fed with urea to help hide the taste of the urea. T F

9. Protein is the least expensive ingredient in the ration and should be fed free choice. T F

ANSWERS:

1. Ruminants
2. True
3. False
4. False
5. True
6. False
7. True
8. True
9. False

8. USING FORAGES IN FEEDING LIVESTOCK

8.1 Performance Objective

Given a written check-out activity concerning using forages in feeding livestock, the student will complete the activity with 80 percent accuracy.

8.2 Teaching-Learning Activities

a. This section on using forages in feeding livestock can best be taught using the problem-solving procedure. Prepare appropriate problems for class use.

b. Obtain samples of several forages to use in class.

c. Visit university field days on forage management.

d. Take field trip(s) to farms or universities to see various forages grown with different practices being used.

e. Use resource persons such as extension personnel to get the latest forage information.

f. Have students look for articles on forages in farm magazines.

g. Take or send samples of forages to be tested for nutrient values. Some universities and private companies have such testing facilities.

8.2.1 Recognizing the potential for expanded uses of forages and better forage management:

a. Forages are one of Kentucky's cattle and sheep producers' biggest assets and has the greatest potential for expanded herd or flock size.

b. Reasons for making uses of forages:

(1) Forages can be turned into beef or lamb.
(2) Forages are a noncompetitive feedstuff (humans do not eat forages).
(3) Many forage systems utilize land that is unsuited for other crops (marginal lands can be brought into greater production).
(4) Improved forage management also improves wildlife habitat.
(5) Forages are the most economical feed for cattle and sheep.
(6) Forages, when properly managed, can provide most of the needs of beef cattle and sheep.

8.2.2 Grazing systems for Kentucky:

(See transparency masters 8.2.2a, 8.2.2b, 8.2.2c, 8.2.2d, 8.2.2e, 8.2.2f, and 8.2.2g.)

a. Continuous grazing is the most common system in Kentucky, requires the least labor and management, and generally is the least productive. Advantages include less labor and management required, excess forage in overproduction seasons can be harvested, and individual animal performance is greater. Disadvantages are lower total animal production per acre and the system's failure to take advantage of the forage curve in Kentucky. Cattle are usually understocked or overstocked for maximum production to be achieved.

b. Rotational grazing provides for the grazing of pastures during optimum yield and quality stage of development while regrowth is occuring in previously grazed fields. Advantages include greater stocking rates, greater animal production per acre, and better use of forage growth habits in Kentucky. The disadvantages is that much better management is required (choosing the optimal time to move cattle, evaluating nutritional value of forage, etc.).

c. Strip grazing is designed to provide a limited area to be grazed. Animals are stocked at higher rates and temporary fences (usually electric) are used. Animals are moved frequently (daily or every other day) to provide for their forage needs. Strip grazing should be used when tall-growing plants like millets, sudangrasses and alfalfa are being grazed. The advantages are that animals make more efficient utilization of plant growth at the proper stages, and the system provides for a period of regrowth for vegetation. Total animal production is greater due to increased stocking rate. The disadvantages are lower individual animal production and the requirement of a greater amount of labor and management.

d. Zero grazing is the mechanical harvesting and immediate feeding of all forage produced. Advantages are that forage can be utilized at optimum yield and quality, total animal production per acre is greater, fencing is not necessary, and excess forage can be stored. Disadvantages include the requirements of greater labor, machinery and investment, and the fact that bad weather can cause supply problems.

e. Deferred grazing is the practice of allowing an accumulation of forage to develop in the fall to be used in late winter. Advantages are that the feed is of better quality (especially tall fescue), and less labor is involved. Disadvantages include lower stocking rates in the fall and, to be used to best advantage, strip grazing practices should be followed.

8.2.3 Providing harvested forages for livestock:

a. Harvested forages should be provided

(1) When pastures do not supply the roughage needs of livestock.
(2) During periods of heavy snow or drought.

b. In feeding harvested forages,

(1) Generally feed all of the quality roughage that livestock can consume (it is still the least expensive ingredient in the ration). Exceptions may be made for gestating beef cows and producing dairy cows.
(2) Low quality roughages can be made more palatable by the addition of molasses or when stored as silage.
(3) Consider the size, age and the dry matter of the roughages being fed.

8.2.4 Hay feeding systems for Kentucky:

a. Hay can best be fed when it is separated according to quality and animals are separated according to needs.

b. Best quality hays should be fed to young animals, yearlings, or animals during lactation.

c. The major objective for all hay feeding systems is to minimize hay losses and permit animals to utilize the majority of hay offered at a feeding.

8.2.5 Guidelines for feeding various hay packages:

a. Conventional bales:

(1) Store under shelter.
(2) Feed in hay racks or bunks when possible.
(3) If fed on sod, provide enough hay for one day's consumption and move feeding site daily.

b. Small round bales:

(1) These generally are left in the field for later consumption.
(2) Restricted intake is necessary to prevent wastage (35 percent more hay is needed if animals have unlimited access).

c. Large round bales:

(1) Unrestricted access to large bales results in wastage.
(2) Feeding racks, wire barriers, etc., should be used.
(3) Large bales can be unrolled when only enough hay is being fed for one day's intake (fed on sod).
(4) Large hay packages should be weighed to prevent underfeeding. (Many large balers do not make as large a bale as indicated by advertising.)

(5) Wastage can be prevented by storing round bales in barns.
(6) When stored outside, leave three feet of room between bales to allow for bale spread after storage and to allow water to run off.

d. General practices to follow when feeding hay:

(1) Try to produce, harvest and store only high quality hay.
(2) Match hay quality to animal needs.
(3) When feeding outside, feed on a well-drained site to reduce bottom spoilage and prevent unsanitary conditions.
(4) Restrict animal access to hay and length of feeding period.
(5) Force hay cleanup by animals which have low nutrient requirements before feeding more hay.
(6) Reseed areas of sod killed as a result of feeding.

8.3 Supplementary Materials

References: 1. See books listed under List of Resources at back of unit.

2. Beef Forage System, ID-5.

3. Dairy: Feeding Corn Silage to Dairy Cattle, ASC-39.

4. Dairy: Kentucky Forage Testing Program, ASC-31.

5. Producing Slaughter Beef With Grain on Pasture, ASC-56.

6. Southern Regional Beef Cow-Calf Handbook: Grazing Systems, ASC-50.

Transparency Masters: 1. 8.2.2a, "Generalized Pasture Availability Curve for Cool Season Perennial Grasses."

2. 8.2.2b, "Forage 'Management Fields' for Year-Round Forage Supply."

3. 8.2.2c, "Cow-Forage Calendar Clock."

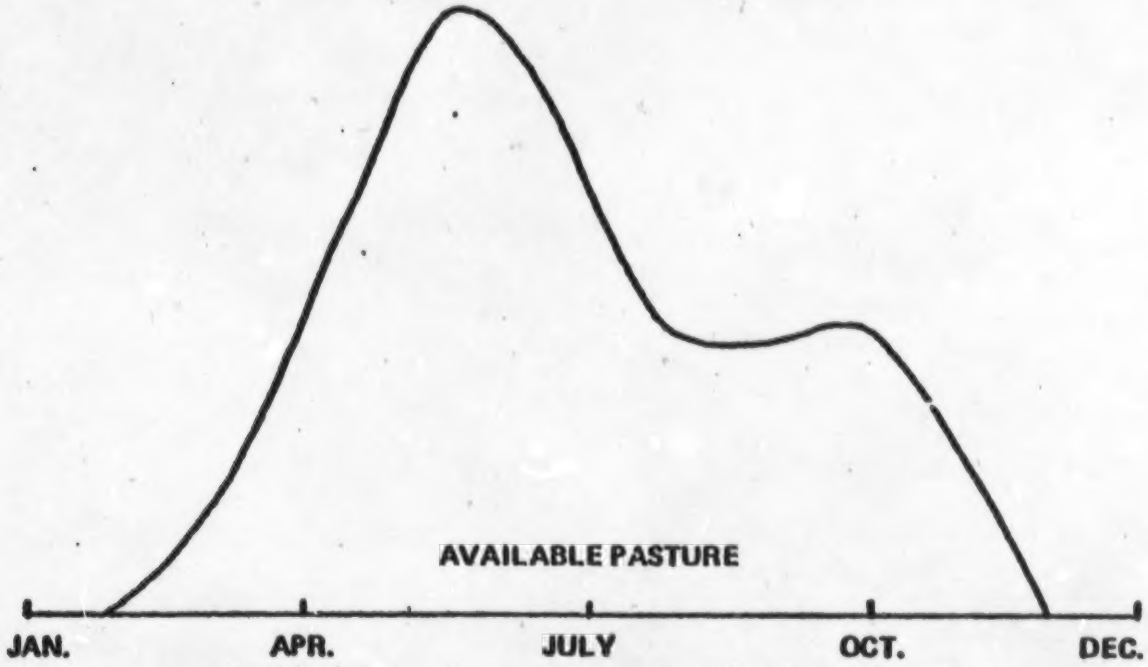
4. 8.2.2d, "Grass Availability Curves."

5. 8.2.2e, "Legume Availability Curves."

6. 8.2.2f, "The Annual Energy Demand Curve of the Spring Calving Beef Cow and Calf."

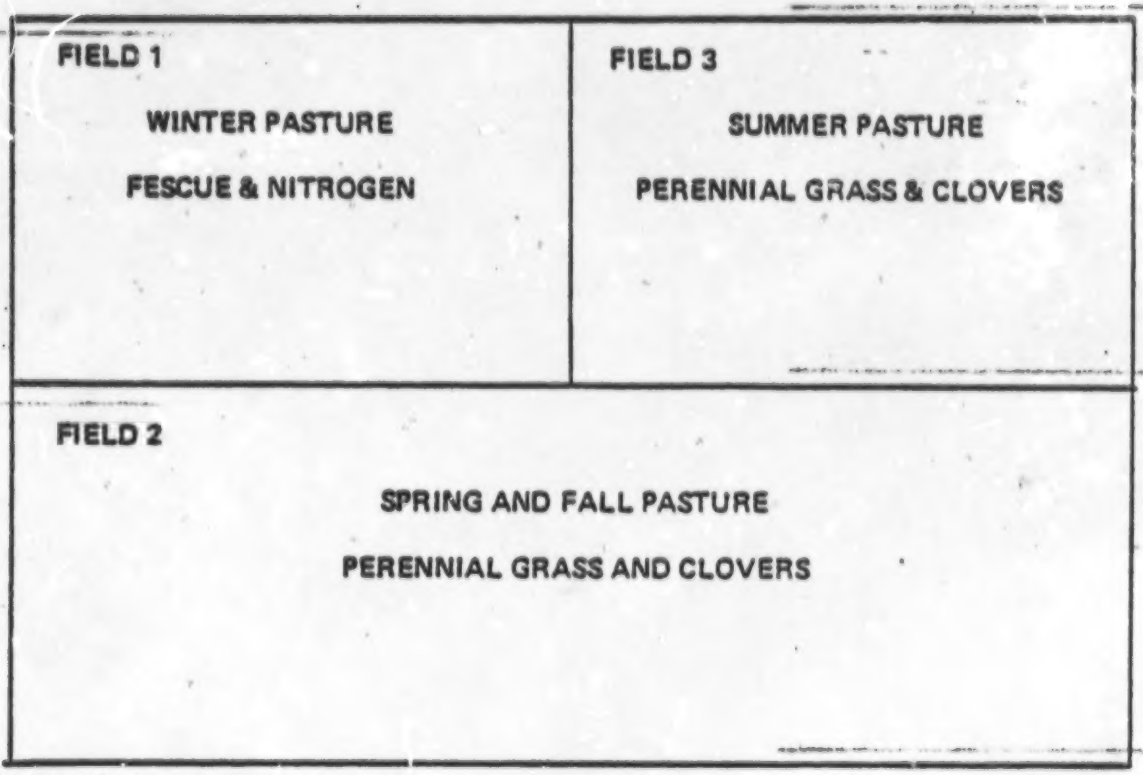
7. 8.2.2g, "Guide to Grazing Management."

GENERALIZED PASTURE AVAILABILITY CURVE FOR
COOL SEASON PERENNIAL GRASSES



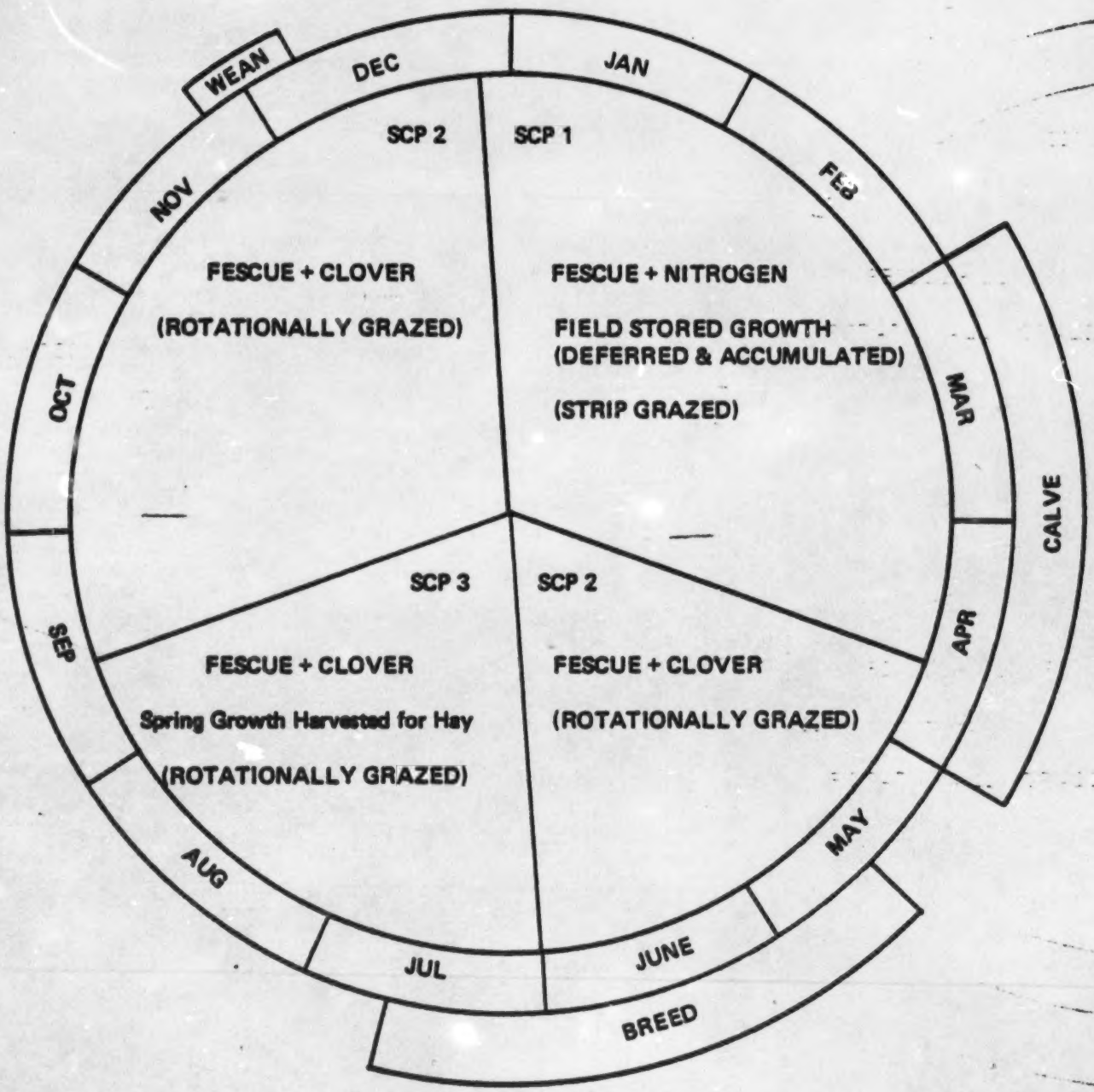
SOURCE: Templeton, et al. 1970. University of Kentucky Bulletin 709.

FORAGE "MANAGEMENT FIELDS" FOR
YEAR-ROUND FORAGE SUPPLY



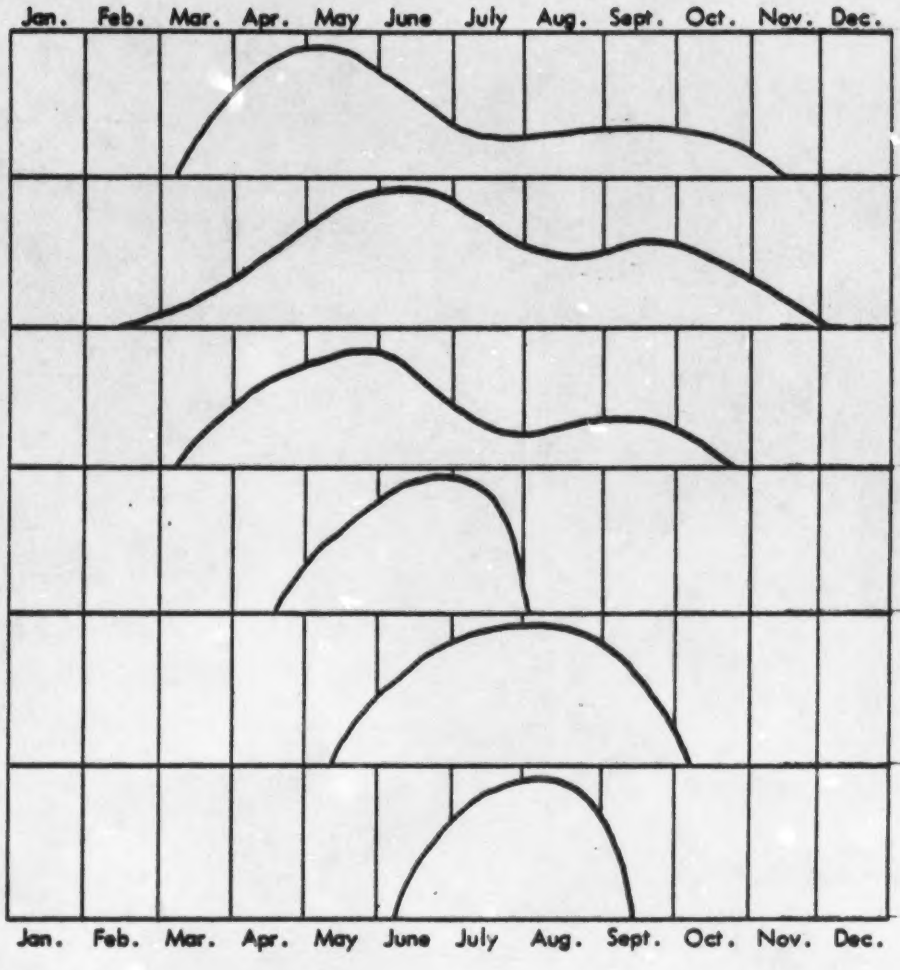
Source: Beef Forage Systems

Cow-forage Calendar Clock



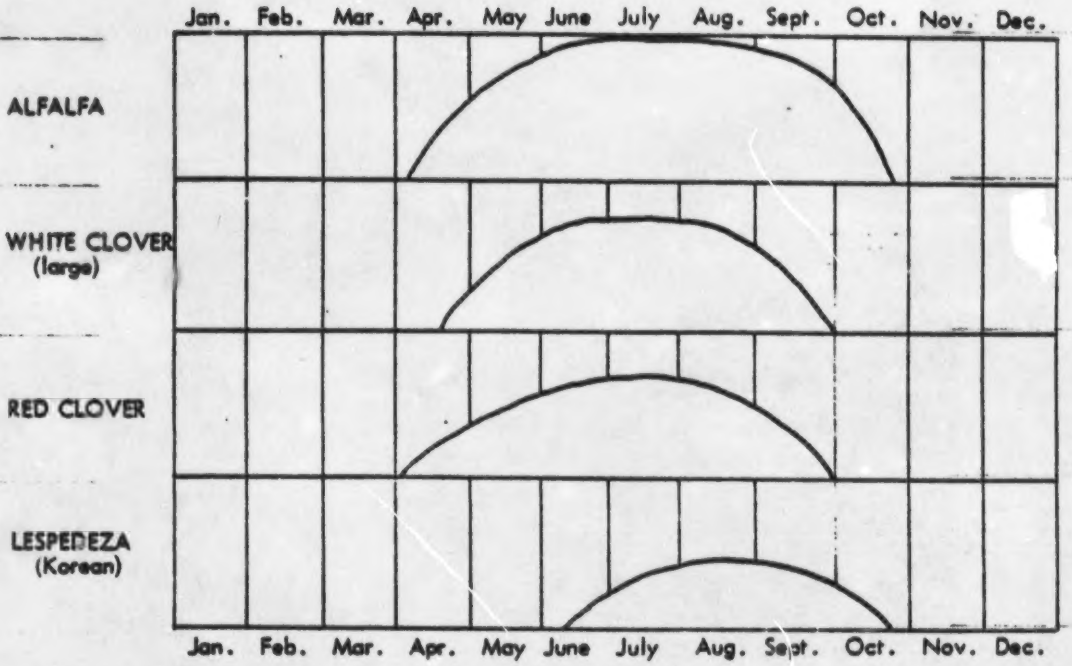
SOURCE: Beef Forage Systems

GRASS AVAILABILITY CURVES



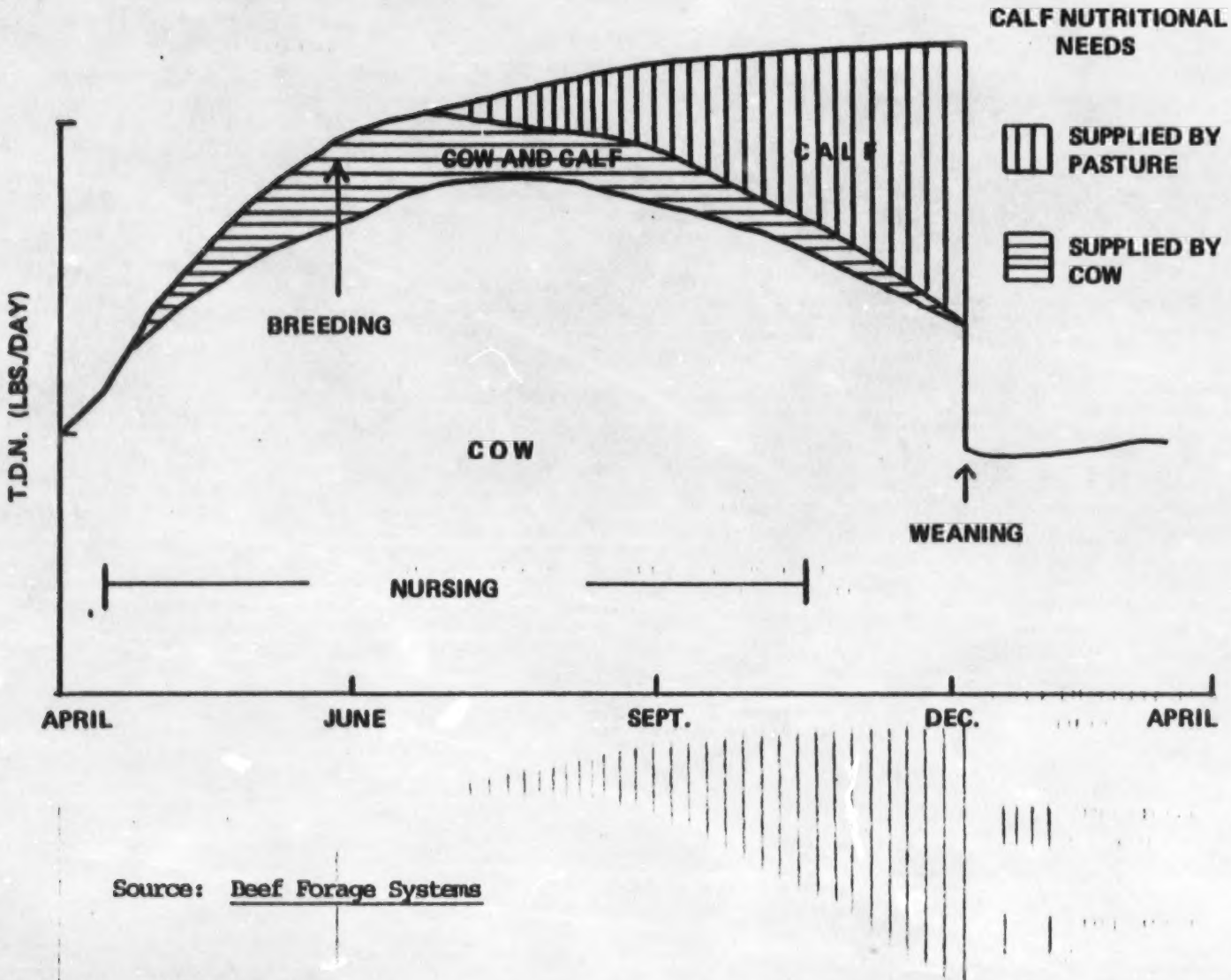
Source: Graze More Beef

LEGUME AVAILABILITY CURVES


Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
ALFALFA
WHITE CLOVER (large)
RED CLOVER
LESPEDEZA (Korean)
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

Source: Graze More Beef

THE ANNUAL ENERGY DEMAND CURVE OF
THE SPRING CALVING BEEF COW AND CALF



Source: Beef Forage Systems

TM 8.2.2f

GUIDE TO GRAZING MANAGEMENT

Source: Graze More Beef

8.4 Check-Out Activities

Provide students with the following exercise:

1. Describe the procedure for feeding conventional bales properly.

2. Describe how to utilize small round bales in feeding livestock.

3. Give four reasons for utilizing forages in Kentucky.

4. Give two advantages of each of the following grazing systems:

   a. Continuous grazing
   b. Rotational grazing
   c. Strip grazing
   d. Zero grazing
   e. Deferred grazing

ANSWERS:

1. a. Store under shelter.
   b. Feed in hay racks or bunks when possible,
   c. If fed on sod, provide enough hay for one day's consumption and move feeding site daily.

2. a. Generally leave them in the field for later consumption.
   b. Restrict intake to prevent waste.

3. a. Forages can be turned into beef or lamb.
   b. Forages are a noncompetitive feedstuff.
   c. Many forage systems utilize land that is unsuited for other crops.
   d. Improved forage management also improves wildlife habitat.
   e. Forages are the most economical feed for cattle and sheep.
   f. Forages when properly managed can provide most of the needs of beef cattle and sheep.

4. a. Advantages of continuous grazing are:

      (1) Less labor.
      (2) Less management.
      (3) Excess forage in over-production seasons can be harvested.
      (4) Individual animal performance is greater.

   b. Advantages of rotational grazing are:

      (1) Greater stocking rates.
      (2) Greater animal production per acre.
      (3) Better use of forage growth rates.

c. Advantages of strip grazing are:

(1) More efficient utilization of plant growth at proper stages.
(2) Provides for a period of regrowth for vegetation.

d. Advantages for zero grazing are:

(1) Forages can be utilized at optimum yield and quality.
(2) Animal production per acre is greater.
(3) Fencing is not necessary.
(4) Excess forage can be stored.

e. Advantages of deferred grazing are:

(1) Feed is of better quality.
(2) Less labor is involved.

9. IMPORTANCE OF PROVIDING CLEAN WATER FOR LIVESTOCK

9.1 Performance Objective

Given a written check-out activity relating to providing clean water for livestock, the student will complete the activity with 80 percent accuracy.

9.2 Teaching-Learning Activities

a. This lesson on providing clean water to livestock can best be taught using the problem-solving procedure. Prepare appropriate problems for class use.

b. Take students and water samples to a water testing facility such as the Health Department or have students collect water samples to send to a testing facility.

c. Take field trip(s) to visit different kinds of water systems.

d. Use resource persons such as Public Health and Environmental Protection Agency personnel.

e. Ask students to obtain material on water from newspaper articles, magazines, industry and governmental agencies.

9.2.1 Reasons water is important for good health and high production:

a. Water makes up 60-75 percent of the bodies of animals. Milk is 87 percent water and eggs are 65 percent water.

b. Water is essential for most body processes.

c. Animals will die more quickly from lack of water than from lack of food.

d. Adequate amounts of fresh clean water are essential for high production.

9.2.2 Average daily requirements of water for farm animals:

a. Beef Cow ---------- 10-12 gallons

b. Dairy Cow ---------- 15 gallons

c. Sheep ---------- 1-1½ gallons

d. Market Hogs ---------- 3-5 gallons

e. Sow and Pigs ---------- 6 gallons

f. Poultry (100 hens) ---------- 6 gallons

g. In general, free choice, fresh, clean water should be available for livestock.

9.2.3 Sources of water for livestock:

a. Best sources--wells and springs.

b. Good sources--cisterns and reservoirs.

c. Running streams and rivers pose the problem of chances of diseases being transported downstream.

d. Poor sources--shallow ponds and partially dried up creeks or streams.

e. During winter months, water should not fall below 40° F, if possible.

9.3 Supplementary Materials

References: See books listed under List of Resources at back of unit.

9.4 Check Out Activities

Provide students with the following exercise:

1. List three reasons livestock need a supply of good fresh clean water.

2. Give the daily water requirements for each of the following animals:

   a. Dairy cow
   b. Beef cow
   c. Sow and pigs
   d. Sheep

3. List three sources of clean water that can be utilized for livestock.

ANSWERS:

1. a. Water makes up 60-75 percent of the bodies of animals.
   b. Water is essential for most body processes.
   c. Animals will die more quickly from lack of water than lack of food.
   d. Adequate amounts of fresh clean water are necessary for high production.

2. a. 15 gallons
   b. 10-12 gallons
   c. 6 gallons
   d. 1-1½ gallons

3. a. Wells
   b. Springs
   c. Cisterns
   d. Reservoirs

LIST OF RESOURCES

Books

Animal Science, 7th ed., M. E. Ensminger. The Interstate, Danville, Illinois, 1977. 1047 pages.

Feeds and Feeding, 1st ed., Arthur E. Cullison. Reston Publishing Company, Inc., Reston, Virginia, 1975. 486 pages.

Feeds and Nutrition, 1st ed., M. E. Ensminger and C. G. Olentine, Jr. The Ensminger Publishing Company, Clovis, California, 1978. 824 pages.

Livestock and Poultry Production, 4th ed. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1975. 630 pages.

The Stockman's Handbook, 5th ed., M. E. Ensminger. The Interstate, Danville, Illinois, 1978. 1192 pages.

Working in Animal Science, Paul Peterson, Allen C. Christensen, and Edward A. Nelson. Gregg Division, McGraw-Hill Book Company, 1978. 248 pages.

Kentucky Cooperative Extension Publications*

A Beef Forage System, ID-5, C. W. Absher, L. W. Murdock, and C. J. Kaiser. 1972. 15 pages.

Beef: Feeding and Management of the Beef Female, ASC-8, John T. Johns, Curtis Absher, and Nelson Gay. 1978. 4 pages.

Dairy: Feeding Corn Silage to Dairy Cattle, ASC-39, Larry R. Prewitt, Roger W. Hemken, and Leonard S. Bull. 1976. 3 pages.

Dairy: Feeding and Managing the Dry Cow, ASC-38, Larry R. Prewitt and John H. Nicolai. 1975. 4 pages.

Dairy: Feeding Dairy Heifers, ASC-20, Ron Wendlandt and Roger Hemken. 1972. 2 pages.

Dairy: Group Handling of Dairy Cows, ASC-28, Gordon S. Hess and John Nicolai. 1975. 2 pages.

Dairy: Kentucky Forage Testing Program, ASC-31, Gordon Hess. 1975. 4 pages.

Effects of Feeding Nitrates to Dairy Cattle, ASC-35, Larry R. Prewitt. 1975. 2 pages.

Feed Additives for Swine, ASC-63, Mack D. Whitaker, Virgil W. Hays, and Gary R. Parker. 1979. 4 pages.

Feeding Lactating Cows for Maximum Production, ASC-59, Gary T. Lane, Perry W. Clark, Leonard S. Bull, and R. W. Hemken. 1979. 6 pages.

Grazing Systems, ASC-30, W. H. Sell. 1977. 4 pages.

Grouping the Commercial Beef Herd for Winter Feeding, ASC-78, John Thomas Johns and James B. Neal. 1979. 4 pages.

Nutrient Requirements of Dairy Animals and Composition of Feedstuffs, ASC-34, Larry R. Prewitt. 1975. 7 pages.

Principles of Balancing a Ration, ASC-70. J. R. Jones, J. C. Ray, and L. H. Johnson. 1979. 8 pages.

Salvage Feeds for Beef Cattle, ID-9, Nelson Gay, Curtis Absher, and Lloyd Murdock. 1973. 7 pages.

Swine: Feeding and Managing the Sow and Litter, ASC-1, M. D. Whitaker, D. O. Liptrap, and R. Edwards. 1972. 1 page.

*These are available free of charge from your county cooperative extension office or can be ordered in quantity (up to one per each two students in your largest class) through the Department of Vocational Education, University of Kentucky, Room 43 Dickey Hall, Lexington, Kentucky 40506.

Movies

The Biotin Story, Color, 23½ minutes. Farm Film Foundation.

Plus or Minus Vitamin E, Color, 21 minutes. Farm Film Foundation.

The Protein Bogus, Color, 12 minutes. Farm Film Foundation.

These movies are available from the following distributor free except for return postage:

Farm Film Foundation, Suite 424, Southern Building, 1425 H Street, N. W., Washington, D.C. 20005.

Slides

Ruminant Stomachs in Beef Animals (26 slides, script, and cassette tape). Hobar Publications, 1234 Tiller Lane, St. Paul, Minnesota 55112. Price: $15.50.

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